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United States Department of Agriculture

Natural Resources Conservation Service

unlock the SECRETS IN THE SOIL

Monitoring Soil Health

April 18 | Soil Matters Conference, Concord NH

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National Soil Health Division

Natural Resources Conservation Service

nrcs.usda.gov/

Soil Health

Soil Health: the continued capacity of the soil to function as a *vital living ecosystem* that sustains plants, animals, and humans

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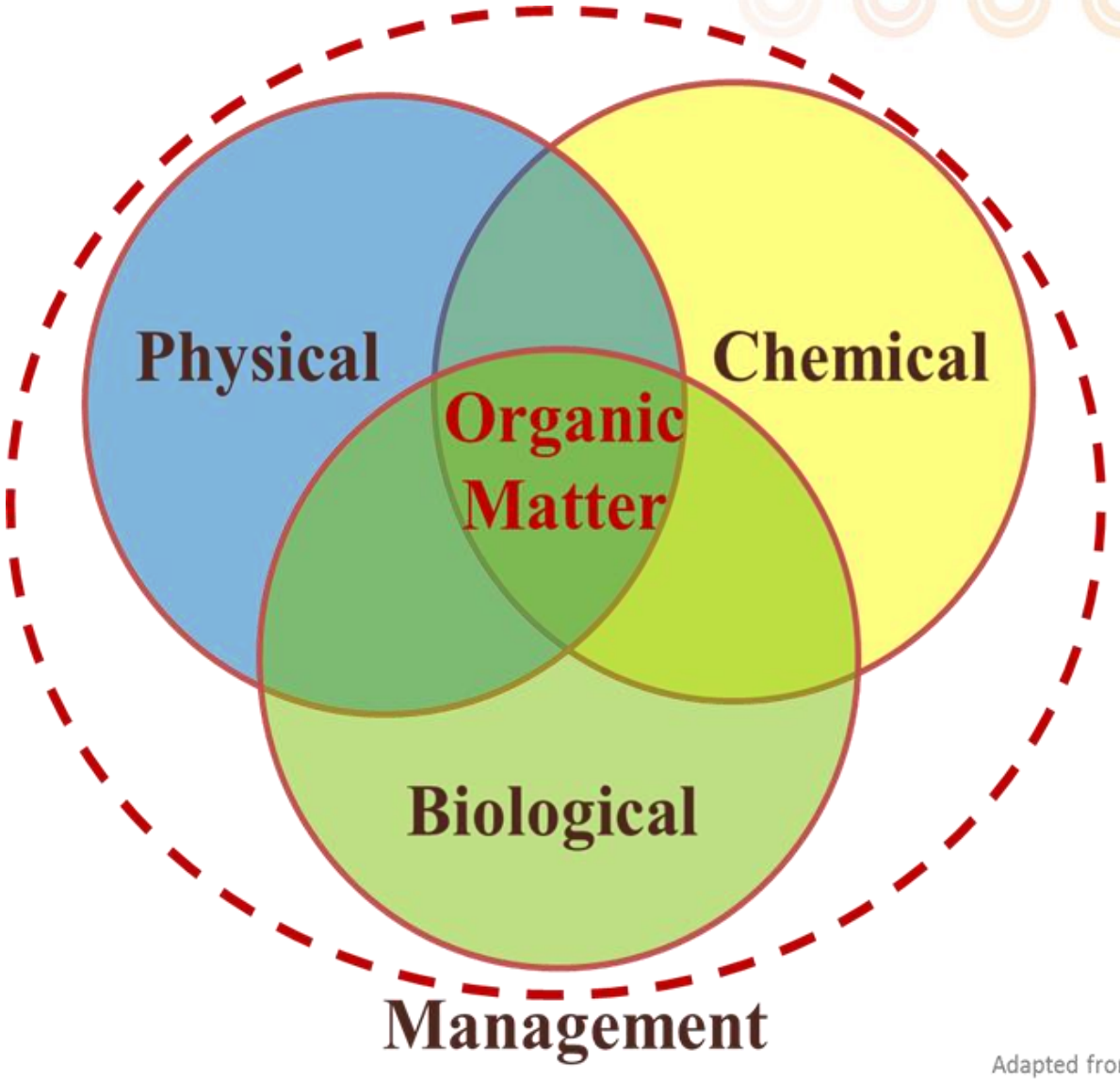
Soil Health

- Soil treated as a living organism
- Recent focus on evaluating habitat and food source for soil organisms and other beneficials
- A lot of interest with improving and monitoring soil health
- Few offerings
- Difficult to interpret
- Not necessarily standardized

Soil Health



Adapted from Cornell University

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Cornell Soil Health Assessment

Joe Vegland
123 Main St.
Anytown, NY, 12345

Agricultural Service Provider:
Smith, George
Jim's Consulting
George@jimsconsulting.com

Sample ID: A_123
Field/Treatment: Field
Tillage: No Till
Crops Crown: MIX, MIX, MIX
Date Sampled: 5/31/2014
Given Soil Type: Anytown
Given Soil Texture: Silt Loam
Coordinates: 42.44790 °N; 76.47570

Measured Soil Textural Class: Silt Loam **Sand: 5%** **Silt: 70%** **Clay: 25**

Test Report

	Indicator	Value	Rating	Constraint
Physical	Available Water Capacity	0.13	28	Water Retention and Availa
Physical	Surface Hardness	148	62	
Physical	Subsurface Hardness	425	8	Subsurface Pan/Deep Compacti Rooting, Water and Nutrient
Physical	Aggregate Stability	22.5	26	Aeration, Infiltration, Rooting, Sealing, Erosion, Runof
Biological	Organic Matter	3.2	42	
Biological	ACE Soil Protein Index	6.5	35	
Biological	Root Pathogen Pressure	5.5	44	
Biological	Respiration	1.17	15	Soil Microbial Abundance and
Biological	Active Carbon	391	12	Energy Source for Soil Bi
Chemical	pH	6.0	71	
Chemical	Phosphorus	9.3	100	
Chemical	Potassium	264.7	100	
Chemical	Minor Elements Mg: 419 Fe: 1.1 Mn: 12.9 Zn: 1.9		100	
	Overall Quality Score	49		Low

Woods End Laboratories INCORPORATED

Powered by: SOLVITA®

SOIL FERTILITY & HEALTH REPORT

Client
William Brinton
Woods End Farm
290 Belgrade Rd. P.O. Box 297
Mt Vernon, ME 04352
United States

Sample Identity: 9529.3
Acct Number: 100
Sample: Soil: Italy: Lower Vineyard Casa Maria 4

Sample Date: 8/19/2015
Intended Crop: Grapes @ 5 t/a

Solvita Soil Health Factors		RANKING:
Solvita - CO2 Burst	90	Medium
Solvita - SLAN, amino-N	48	Low
Aggregate Stability	35	Medium
Organic Matter	3.2	Medium

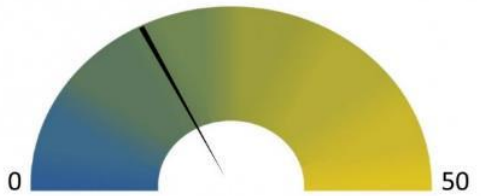
Nutrients Value per hectare available
N + P2O5 + K2O hectare = $221.78

Nutrients Available kg/ha

N	P2O5	K2O
115	229	210

67

OVERALL FERTILITY SCORE



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SOIL HEALTH SCORE

NUTRIENT FERTILITY

Analysis	Units	Level Found
Nitrate-N 0-6"	ppm	10
Additonal Nitrate-N	ppm	nt
Ammonium-N 0-6"	ppm	nt
Profile Avail-N	ppm	10
Biological N-Min	kg/ha	97
N-Estimated For Crops		103
Phosphate as P	ppm	45
Potassium as K	ppm	78
Calcium	ppm	480
Magnesium	ppm	153
Sodium	ppm	37
pH	Units	6.3
EC	dS M	nt
Nutrient Index	Rating	1.00
Most Limiting Factor		None
Other factors		
Water Soluble Carbon	ppm	204
Water Soluble-N	ppm	16
Soluble C:N Ratio	Unit	12.8
Aluminum, Extractable	ppm	135
P-Saturation	ratio	14%
Iron, Extractable	ppm	186

Notes and Recommendations

USDA Cover Crop Recommendations

Types of Cover Crop Blends Suggested:
20% Legume 80% Grass/Non-legume

Nutrient Limitations/Recommendations

Nutrient Required (estimated) per hectare kg

56	17	84	(N - P - K)

Nutrient Deficit (by difference)

0	0	0	(N - P - K)

Notes on the Report: Soil Health Score integrates: Respiration, Amino-N, Aggregate Stability and Organic Matter
Overall Fertility integrates Health Score and N-min + relative P & K

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Soil Health Assessment Center
University of Missouri

Soil Health Assessment

Basic Soil Health Package	$36
Potentially Mineralizable Nitrogen	
Active Carbon	
Wet Aggregate Stability	
pH (salt and water)	

- Reduce nitrogen expenditures —take credit for nitrogen released by soil during growing season.
- Estimate activity of soil organic matter and soil microorganisms
- Evaluate soil structure and water relationships
- Optimize pH and crop suitability; maximize nutrient availability.

Expanded Soil Health Package	$80
Potentially Mineralizable Nitrogen	
Total Nitrogen	
Active Carbon	
Total Organic Carbon	
Water Stable Aggregates	
pH (salt and water)	
Effective Cation Exchange Capacity	
Exchangeable Cations	
Plant Available Phosphorus	

- Gain all the benefits of the Basic Package
- Add total Nitrogen and Carbon to the analyses to put perspective on PMN and active carbon
- Measure ECEC, capacity of soil to hold cations (calcium, magnesium, potassium, sodium, hydrogen and aluminum) at the current soil pH. Most CEC measurements are made with pH adjusted to 7. ECEC estimates more closely current soil conditions allowing future improvements to be measured.
- Measure effective base saturation, the proportion of ECEC held by the basic cations of calcium, magnesium, potassium and sodium. Hydrogen and aluminum are acidic cations.
- Measure phosphorus available for plant uptake

Package Enhancements	
Phospholipid Fatty Acids (PLFA)	$50
Bulk Density	$ 5
Neutralizable Acidity	$11
Particle Size	$36

These prices apply when analyses are added to Basic or Enhanced Soil Health Pack-

- Add any of these analyses to either of the above packages
- Analyze Phospholipid Fatty Acid content of your soil to estimate the biomass and groups of microbes present in the soil.
- Measure soil bulk density to determine if compaction is limiting crop root growth, water infiltration, and water holding capacity.
- Classify your soil by texture.

SOIL HEALTH

We are currently developing and analyzing other tests to add to our Soil Health program so please call the lab or check our website for further developments and pricing.

PLFA $59.50

Soil biological testing at Ward Laboratories is conducted by analyzing phospholipid fatty acids, or PLFA. PLFA gives a representation of living soil microbial biomass and allows us to identify the presence or absence of various functional groups of interest through known PLFA biomarkers. PLFA is a snapshot of soil community structure and abundance at the time of sampling. As environmental conditions such as temperature and moisture change so does the microbial community. This ability of the soil microbial community to change provides producers with a tool to compare agricultural management techniques with respect to overall better microbial community health.

Haney Test $49.50

The Haney Test is a dual extraction procedure that allows the producer to assess overall soil health. The test is used to track changes in soil health based on management decisions. This test examines total organic carbon and total organic nitrogen to determine a C:N ratio used to make general cover crop recommendations. This test also includes the **Solvita CO_2 Burst Test** to look at microbial activity and potentially mineralizable nitrogen. The weak acid (H3A) extraction represents some available plant nutrients.

Solvita CO_2 Burst Test $25.00

The Solvita CO_2 Burst Test is a new tool which easily and accurately measures soil biological CO_2 respiration. (Solvita.com, 2012)

1-800-887-7645
www.wardlab.com
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WARD Laboratories, Inc.

MIDWEST LABORATORIES

Midwest Laboratories®

SOIL HEALTH COMPLETE: $65.00

is comprised of three components:

1. An in-depth soil analysis that will address the chemical aspects of the soil by S3C Analysis.
2. The Solvita 1-day CO2C test.
3. The Haney test with a Soil Health Calculation.

SOIL HEALTH BASIC: $55.00

is comprised of three components:

1. An basic soil analysis that will address the chemical aspects of the soil by S1AN Analysis.
2. The Solvita 1-day CO2C test.
3. The Haney test with a Soil Health Calcuation.

PLFA (2016)

	Years of CC			P-value	
Biomass, ng/g	1 or less	4 or more	SEM	CC	region
Total	1395	2107	205	0.03	0.43
Bacteria	744	1128	112	0.03	0.53
Fungi	86	223	33.6	0.01	0.32
Arbuscular Mycorrhizal	24	62	11	0.04	0.48
Saprophytes	62	162	26	0.02	0.32
Protozoa	6	19	3	<0.01	0.2
Diversity index	1.35	1.56	0.056	0.02	0.41
Fungi to bacteria	0.116	0.194	0.025	0.05	0.58

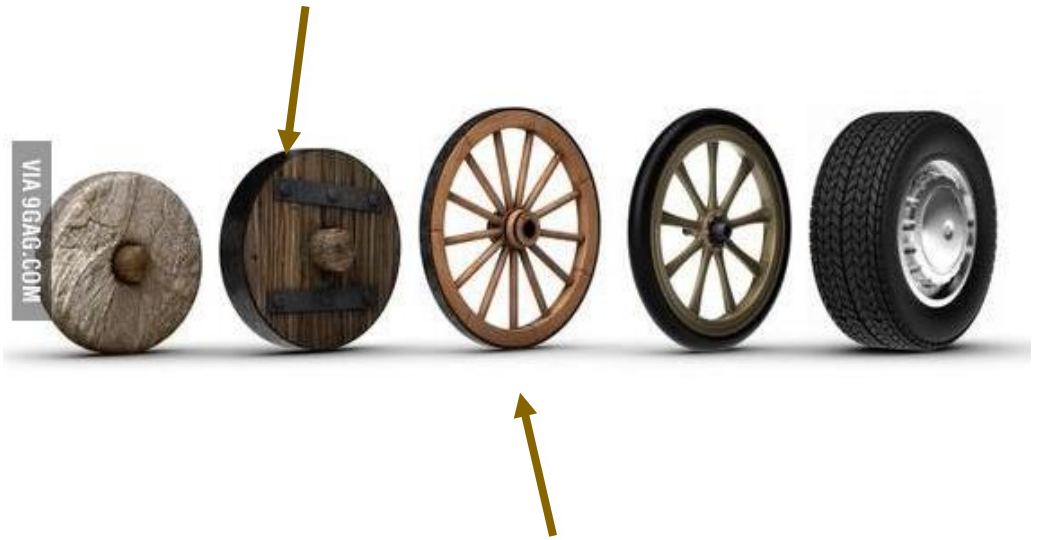
Within No-till fields

Mary Drewnoski, Univ. of Nebraska

Soil Health Assessment

- Establishing standards for ‘current best available’ SH indicators and methods to assess soil health resource concerns
- Potential for use in monitoring ΔSH nationally
- Identifying Resource Concerns and integrating into EQIP and CSP

Soil Quality Assessments of the 90s



Soil Health Assessments

Collaborative Multi-Organizational Team

USDA United States Department of Agriculture

Soil Health Indicators/Methods

*Potential Indicators/Methods

Process	Indicator
SOM Cycling	Organic C (dry combustion)
Water Partitioning	Macro-aggregate Stability
General Microbial Activity	
Short term C Mineralization	4 day respiration
Metabolic Activity	β-glucosidase, NAG
Carbon Food Source	POXC
Bioavailable N	ACE Proteins
Microbial Diversity	PLFA/EL-FAME

Strengthening the Science of Soil Health

Leveraging agency wide technical capacity and infrastructure, as well as partner resources to assess, monitor and enhance Soil Health

Components:

1. Evaluate existing literature on indicators and their interpretation, soil health management systems implementation
2. Leverage existing projects
3. Build and populate NRCS soils database with soil health data
4. Develop soil health management decision tools and citizen science portal
5. Monitor soil health on representative benchmark soils and evaluate management impact

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